Chitin Works America LLC

Maryland Technology Extension Service

Chitinworks America Establishes New Facility With Enhanced Production Processes

Client Profile:
ChitinWorks America, LLC is establishing a chitin/chitosan production facility in Cambridge, Maryland, based on a Maryland Industrial Partnerships (MIPS) research project conducted at the University of Maryland, College Park, two years ago. The company employs six people.

Situation:
After its 2001 processing season, ChitinWorks America set several goals. It wanted to have the lowest unit production cost possible while retaining the same level of quality, and it wanted to establish consistent production processes. The company also wanted to increase its production volume in 2002. However, five key inhibitors presented obstacles to the company achieving its goals: 1) material removal in the initial de-acetylation tank (pretreatment tank); 2) screw conveyors used to transport material between unit processes, particularly the vertical screw used after the demineralization step to feed the deproteination tank; 3) the drying step at the end of the chitin production sequence; 4) the removal of material from the de-acetylation tank in the chitosan production sequence; and 5) the final acid addition in the chitosan production sequence. ChitinWorks America requested the assistance of the Maryland Technology Extension Service (MTES), a NIST MEP network affiliate, to resolve these problems.

Solution:
MTES carefully analyzed the five identified problems at ChitinWorks America and made recommendations for overcoming each obstacle. MTES discovered that the drag chain in the pretreatment tank was causing problems with material removal, and recommended relocating the drive for the drag chain away from the tank exit to eliminate the potential for material build-up on the drive sprocket. In addition to offering an immediate solution for the problem, MTES also recommended that ChitinWorks America pursue the ultimate goal of eliminating the use of mechanical devices to move material through the process and rely on pumping materials throughout the process. The company agreed to conduct studies during the coming season to evaluate the feasibility of pumping to the pretreatment tank.
MTES evaluated the problems ChitinWorks America was having with the vertical screw conveyor between the demineralization tank and the deproteination tank, and recommended the company remove the vertical screw after demineralization

and replace it with a pump and parabolic screen to successfully dewater the chitin.
A bottleneck in the chitin drying process resulted in an over-moist product that required several hundred extra pounds of caustic to dry it out. MTES recommended the company supplement or replace the existing press with a pressure filter press, a change that could conceivably remove the drying process altogether. Secondly, MTES recommended the grain dryer be replaced with a fluidized bed dryer. MTES asked ChitinWorks America to evaluate the economic impact on energy cost and production throughput if the intermediate drying step could be eliminated, and provided sample calculations on the impact of chitin moisture content on dryer loading and product throughput.
When MTES inspected the drain lines on the de-watering auger under the pretreatment tank, it discovered that they were clogged with solids and that the company had to stop its processes to free the lines. The delay resulted in potential product degradation and limited product throughput. MTES recommended the company remove its hard plumbing and replace it with an open trough system, which is less prone to clogging and easily cleared of any obstructions.
Finally, MTES evaluated the addition of acid in the final step of ChitinWorks America's process. Adding acid to the chitosan to adjust the final pH balance was cumbersome and hazardous. An individual had to manually transport and add acid to the tank to bring the solution to the desired pH. A mistake in this step could ruin the final product. MTES recommended the company install an acid pump with a pH controller to replace the manual addition of the acid. The control system should also include a time-out feature as a safeguard.
ChitinWorks America is in the process of implementing MTES's numerous recommendations as it prepares for the coming production season. It is relocating the drive for the drag chain away from the tank and incorporating several of the recommended chain cleaning techniques. The company is also planning to conduct studies during the coming season to evaluate the feasibility of grinding the shell and pumping to the initial de-acetylation tank (pretreatment tank). The company plans to also investigate both pressure filters and fluidized bed dryers during the coming season. The company replaced the pipe system on the dewatering auger under the de-acetylation tank in the chitosan production with the recommended trough system. The trough system eliminated the clogging problem and the company is able to process two batches per day rather than one. The company also replaced the manual acid addition step with an acid pump and pH controller. The process is safer and the company now has much better control over this step of the process.

Results:
Increased sales by $300,000.
Retained sales of $200,000.
Doubled throughput.
Saved $150,000 in lost opportunity cost savings.
Invested $50,000 in capital equipment.

Saved $5,000 in workforce practices by enhancing employee skills.
Saved one job.
Saved $5,000 in regulatory compliance fees and $5,000 in injury compensation.

Testimonial:
"The Maryland Technology Extension Service has provided us with invaluable assistance in putting in place the right technology for the job. We are currently building and operating an experimental production facility which has required extensive planning and plant reconfiguring as we continue to refine our operations. MTES has been with us every step of the way providing us with the expertise to evaluate and help implement change."

Charles P. Condon, Managing Partner